REMARKS

The Final Office Action mailed February 26, 2007, has been received and reviewed. Claims 21-25 and 27-43 are currently pending in the application. Claims 21-25 and 27-42 stand rejected. Claim 43 is allowed. Applicants have amended claims 21-25, 27-29, 31, and 32, canceled claim 30, and respectfully request reconsideration of the application as amended herein.

Claim 21 has been amended to replace the transitional phrase "consisting essentially of" with the transitional phrase "consisting of" and to clarify the scope of the claim. Claims 22-25, 27-29, 31, and 32 have been amended to improve antecedent basis. No new matter has been added.

Objections to Claims

Claim 30 is objected to under 37 C.F.R. § 1.75(c) as allegedly being of improper dependent form for failing to further limit the subject matter of a previous claim. Applicants have canceled claim 30, rendering moot this objection.

35 U.S.C. § 103(a) Obviousness Rejections

Obviousness Rejection Based on Leonard *et al.*, "Development of a Solvent Extraction Process for Cesium Removal from SRS Tank Waste" in view of Wood *et al.*, "Extraction of Lead and Strontium from Hazardous Waste Streams by Solvent Extraction with 4′, 4′, (5′)-di-(t-butyldicyclohexo)-18-crown-6"

Claims 21-25 and 27-42 stand rejected under 35 U.S.C. § 103(a) as being unpatentable over Leonard *et al.*, "Development of a Solvent Extraction Process for Cesium Removal from SRS Tank Waste" ("Leonard") in view of Wood *et al.*, "Extraction of Lead and Strontium from hazardous Waste Streams by Solvent Extraction with 4′, 4′, (5′)-di-(t-butyldicyclohexo)-18-crown-6" ("Wood"). Applicants have canceled claim 30, rendering moot the rejection of this claim. Applicants respectfully traverse this rejection as to the remaining claims, as hereinafter set forth.

M.P.E.P. 706.02(j) sets forth the standard for an obviousness rejection:

> To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the references themselves or in the knowledge generally available to one of ordinary skill in the art, to modify the reference or combine reference teachings. Second, there must

> be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. The teaching or suggestion to make the claimed combination and the reasonable expectation of success must both be found in the prior art, and not based on applicant's disclosure. *In re Vaeck*, 947 F.2d 488, 20 USPQ2d 1438 (Fed. Cir. 1991).

The obviousness rejection of claims 21-25, 27-29, and 31-42 is improper because the cited references do not teach or suggest all of the claim limitations and do not provide a motivation to combine to produce the claimed invention.

Leonard teaches removing cesium from basic hazardous waste streams using calix[4]arene-bis-(tert-octylbenzo)-crown-6 ("BOBCalixC6"), 1-(1,1,2,2-tetrafluoroethoxy)-3-[4-(tert-octylphenoxy)-2-propanol ("Cs-3"), and Isopar® L. Leonard at p. 745-746. A solvent composition including BOBCalixC6, 1-(2,2,3,3-tetrafluoropropoxy)-3-[4-(sec-butylphenoxy)-2-propanol (referred to as "Cs-7SBT" in Leonard), trioctylamine, and Isopar® L was also produced. *Id.* at p. 758.

Wood teaches removing lead and strontium from acidic hazardous waste streams using a solvent composition that includes 4′, 4′, (5′)-di-(t-butyldicyclohexo)-18-crown-6 ("DtBu18C6"), n-tributyl phosphate ("TBP"), and Isopar® L. Wood at the Abstract.

The cited references do not teach or suggest all of the limitations of claim 21, as amended, because the cited references do not teach or suggest the limitation of "contacting an acidic solution comprising cesium and strontium with a mixed extractant solvent consisting of calix[4]arene-bis-(tert-octylbenzo)-crown-6 ("BOBCalixC6"), 4′,4′,(5′)-di-(t-butyldicyclohexano)-18-crown-6 ("DtBu18C6"), and 1-(2,2,3,3-tetrafluoropropoxy)-3-(4-sec-butylphenoxy)-2-propanol ("Cs-7SB") dissolved in a diluent." Since Leonard teaches a solvent composition that includes BOBCalixC6, Cs-7SBT, trioctylamine, and Isopar® L and Wood teaches a solvent composition that includes DtBu18C6, TBP, and Isopar® L, the cited references do not teach or suggest a mixed extractant solvent that consists of the components recited in claim 21. As such, Leonard and Wood do not teach or suggest contacting an acidic solution with such a mixed extractant solvent.

Leonard and Wood also do not teach or suggest the above-mentioned limitation since neither reference teaches or suggests contacting an acidic solution with a mixed extractant solvent that consists of the components recited in claim 21. Rather, Leonard teaches contacting a

basic solution with a mixture of BOBCalixC6, Cs-7SBT, trioctylamine, and Isopar® L, while Wood teaches contacting an acidic solution with a mixture of DtBu18C6, TBP, and Isopar® L.

The cited references also do not provide a motivation to combine to produce the claimed invention. To provide a motivation or suggestion to combine, the prior art or the knowledge of a person of ordinary skill in the art must "suggest the desirability of the combination" or provide "an objective reason to combine the teachings of the references." M.P.E.P. § 2143.01. The mere fact that references can be combined or modified does not render the resultant combination obvious unless the prior art also suggests the desirability of the combination. *Id.* (emphasis in original).

Applicants respectfully submit that Leonard or Wood, alone or in combination, does not suggest the desirability of, or provide an objective reason for, combination. Specifically, nothing in Leonard suggests the desirability of, or provides an objective reason for, using DtBu18C6 in its solvent composition. Leonard also does not suggest the desirability of, or provide an objective reason for, removing trioctylamine from its solvent composition. Wood also does not suggest the desirability of, or provide an objective reason for, using BOBCalixC6 and Cs-7SBT in its solvent composition and removing TBP from its solvent composition. In addition, neither reference teaches or suggests that components of their respective solvent compositions are useful for removing radionuclides from both basic and acidic solutions. Applicants note that Leonard teaches removing cesium from a basic solution using its solvent composition and Wood teaches removing lead and strontium from an acidic solution using its solvent composition. As such, Leonard and Wood do not suggest the desirability of, or provide an objective reason for, contacting an acidic solution with a mixed extractant solvent that consists of the components recited in claim 21.

The Examiner states that "it would have been obvious to one of ordinary skill in the art at the time the invention was made to have modified the process described in the Leonard et al. article by including the [DtBu18C6] taught in the abstract of the Wood et al. article into the extraction solvent of the Leonard et al. article because of the expected advantage of extracting strontium." Office Action of February 26, 2007, p. 4. The Examiner further states that "the 'intended purpose' is the extraction of strontium . . . and the 'known material' is the [DtBu18C6]." *Id.* However, neither of the cited references suggests the desirability of, or provides an objective reason for, coextracting strontium and cesium. In addition, "[a] prior art

reference must be considered in its entirety." M.P.E.P. § 2141.02. The Examiner overlooks the teachings of Wood that DtBu18C6 is used in combination with TBP to remove strontium. Since Wood teaches that the DtBu18C6 and TBP extract strontium, there is no support for the Examiner's position that the "intended purpose" of DtBu18C6, alone, is to extract strontium.

As further support for Applicants' argument, a copy of an article entitled "Combined Extraction of Cesium and Strontium from Alkaline Nitrate Solutions" by Delmau *et al.* is enclosed. This article is cited herein in a Supplemental Information Disclosure Statement. At p. 200-206, this article describes that a solution of BOBCalixC6, Cs-7SB, trioctylamine, and Isopar® L did not effectively extract both cesium and strontium from an alkaline solution. Adding DtBu18C6 to this solution also did not effectively extract both cesium and strontium from the alkaline solution. Effective extraction of cesium and strontium from the alkaline solution was only achieved when DtBu18C6 and a lipophilic carboxylic acid, such as 2-*n*-dodecyl-2-methylmyristic acid, were added to the solution. Applicants respectfully submit that the results of the experiments conducted in this article refute the Examiner's position that it would be obvious to combine the DtBu18C6 taught in Wood with the solvent composition taught in Leonard to produce the claimed invention.

Applicants also respectfully submit that the above-mentioned article does not constitute prior art under any section of 35 U.S.C. § 102 and is provided merely in support of Applicants' argument that there is no motivation to combine Leonard and Wood.

Applicants are citing this article to the Office, even though it is not prior art, to satisfy the duty of candor under 37 CFR 1.56. 37 CFR 1.56 states that information "material to patentability" must be disclosed to the Office, and defines information as material to patentability if it establishes a *prima facie* case of unpatentability of a claim, refutes a position taken by the applicant in opposing an argument of unpatentability relied upon by the Office, or refutes a position taken by the applicant in asserting an argument of patentability. However, nothing in 37 CFR 1.56 precludes providing information to the Office that is favorable to patentability or refutes the Office's argument of unpatentability.

The Examiner also states that "it would have been obvious to merely add the DTBu18C6 of the Wood reference into the solvent of the Leonard reference only to arrive at a solvent that produces the expected advantage of removing both cesium and strontium from the liquid" and that "one of ordinary skill in the art when faced with the problem of removing both cesium and

strontium from a liquid would immediately envision the combination of the recited solvent components of Leonard . . . [and] . . . Wood." Office Action of February 26, 2007, p. 5-6. However, the Examiner overlooks the fact that Leonard and Wood teach removing radionuclides from different types of solutions (basic solutions and acidic solutions, respectively), which is further evidenced by the Examiner's statement that it would be obvious to combine Wood and Leonard to remove "both cesium and strontium from a liquid." *Id.* at p. 6. However, claim 21 recites contacting an acidic solution with a mixed extractant solvent that consists of the recited components.

The Examiner has not provided any motivation to explain why it would be obvious to combine specific components of the solvent compositions of Leonard and Wood when these solvent compositions are used to remove radionuclides from different solutions. The solubilities of the radionuclides and the components of the solvent compositions differ depending on the pH of the solution in which the radionuclides are present. As such, the effectiveness of the solvent composition to remove the desired radionuclides depends on the components of the solvent composition and the pH of the solution. Therefore, the Examiner's assertion that it would be obvious to add the DTBu18C6 of the Wood reference to the solvent of the Leonard reference "for removing both cesium and strontium from a liquid" is conclusory and is not supported by objective evidence of record.

Furthermore, the combination of Leonard and Wood does not produce the claimed invention. Instead, the combination of Leonard and Wood produces a solvent composition that includes BOBCalixC6, Cs-7SBT (referred to as Cs-7SB in claim 21), DtBu18C6, trioctylamine, TBP, and Isopar® L. Since such a solvent composition does not consist of the components recited in claim 21, combining Leonard and Wood does not produce the invention of claim 21.

Applicants also respectfully submit that the claimed invention provides unexpected results. Greater than expected results are evidence of nonobviousness. M.P.E.P. § 716.02(a). "Evidence of unexpected properties may be in the form of a direct or indirect comparison of the claimed invention with the closest prior art which is commensurate in scope with the claims." M.P.E.P. § 716.02(b). As described in at least paragraphs [0033], [0048], [0049], and [0054]-[0061] of the as-filed specification, an extractant solution that included DtBu18C6, TBP, BOBCalixC6, Cs-7SB, trioctylamine, and Isopar® L did not effectively coextract cesium and strontium. Such an extractant solution is substantially identical to that which would be produced

by combining the solvent compositions of Leonard and Wood. Rather, the extractant solution that included DtBu18C6, TBP, BOBCalixC6, Cs-7SB, trioctylamine, and Isopar® L resulted in a distribution ratio for cesium of 0.64 and a distribution ratio for strontium of 1.5. In contrast, the extractant solvent of the claimed invention, which consists of BOBCalixC6, DtBu18C6, and Cs-7SB (as recited in claim 21), results in a distribution ratio for cesium of 8 and a distribution ratio for strontium of 10. The latter increased distribution ratios indicate that the extractant solvent as recited in claim 21 provides improved coextraction of cesium and strontium compared to that produced by combining the respective solvent compositions of Leonard and Wood.

Since the cited references do not teach or suggest all of the limitations of claim 21 and do not provide a motivation to combine to produce the claimed invention, the obviousness rejection is improper and should be withdrawn.

Each of claims 22-25 and 27-42 is allowable, *inter alia*, as depending from an allowable base claim.

Claim 25 is further allowable because the cited references do not teach or suggest contacting the acidic solution with the mixed extractant solvent comprising from approximately 0.086 M to approximately 0.108 M DtBu18C6.

Claim 29 is further allowable because the cited references do not teach or suggest contacting the acidic solution with the mixed extractant solvent consisting of approximately 0.15M DtBu18C6, approximately 0.007M BOBCalixC6, and approximately 0.75M Cs-7SB modifier dissolved in an isoparaffinic hydrocarbon diluent.

Claim 32 is further allowable because the cited references do not teach or suggest extracting the cesium and strontium into a first organic phase.

Claim 35 is further allowable because the cited references do not teach or suggest removing the cesium and strontium at a temperature ranging from approximately 10°C to approximately 15°C.

Claim 36 is further allowable because the cited references do not teach or suggest recovering the mixed extractant solvent, the cesium, and the strontium.

Claim 37 is further allowable because the cited references do not teach or suggest contacting a first organic phase with a second aqueous phase.

Claim 38 is further allowable because the cited references do not teach or suggest extracting the cesium and strontium into the second aqueous phase.

Claim 39 is further allowable because the cited references do not teach or suggest contacting the first organic phase with the second aqueous phase at a temperature ranging from approximately 10°C to approximately 60°C.

Claim 40 is further allowable because the cited references do not teach or suggest contacting the first organic phase with the second aqueous phase at a temperature ranging from approximately 20°C to approximately 40°C.

Claim 41 is further allowable because the cited references do not teach or suggest contacting the first organic phase with an aqueous solution comprising from approximately 0.001M nitric acid to approximately 0.5M nitric acid.

Claim 42 is further allowable because the cited references do not teach or suggest separating a first organic phase and a second aqueous phase.

ENTRY OF AMENDMENTS

The amendments to claims 21-25, 27-29, 31, and 32 should be entered by the Examiner because the amendments are supported by the as-filed specification and drawings and do not add new matter to the application.

CONCLUSION

Claims 21-25, 27-29, and 31-43 are believed to be in condition for allowance, and an early notice thereof is respectfully solicited. Should the Examiner determine that additional issues remain which might be resolved by a telephone conference, the Examiner is respectfully invited to contact Applicants' undersigned attorney.

Respectfully submitted,

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